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Analysis of the Innovative Potential of Russian Border Regions

S V Kupriyanov¹, K S Starikov¹ and S M Mikalut¹

¹Belgorod State Technological University named after V.G. Shukhov, 46 Kostyukova street, Belgorod, 308012, Russia

E-mail: kaf-mvd@yandex.ru, konstantin-starikov@bk.ru, m_sm@bk.ru

Abstract. In the article the innovative potential of the region is interpreted on the basis of the resource approach. The authors generalized the approaches to its assessment and concluded that there is no universal method for measuring the innovative potential of the region, because the components of the innovative potential and the sets of indicators that determine them are not well-established. The assessment mechanism also varies. The objective of the article is to assess the innovative potential of the border regions of Russia, which together form a fairly high contribution to the economic indicators of the country's development. At the same time, as the calculation showed, the border regions play a predominant role in the formation of an imbalance in regional development. Therefore, the assessment and improvement of the innovative potential of border regions plays an important role in leveling the country's economic development. The authors proposed a methodology for assessing the innovative potential of the border region, in which, in contrast to the existing approaches, the contact potential of the region is highlighted. Contact potential allows taking into account the level of innovative development and urbanization of neighboring regions. As a result of approbation of the author's methodology, five Russian border regions (which is 10 percent of their total number) have been identified with high innovation potential. Almost 60 percent of border regions have low innovation potential. The conclusions made in the article can be used to clarify and formulate strategic plans for regional development.

1. Theoretical foundations for assessing the innovative potential of the border region

1.1. Introduction

The need to ensure that the quality of development of the Russian economy is consistent with global scientific and technological challenges increases in an era of high turbulence in the economic, political and social spheres. In this regard, the search for ways to eliminate interregional differences in the level of innovation potential is relevant. The designated problem becomes even more important in the border regional economic systems.

1.2. Interpretation and directions for assessing the innovative potential of the region

The innovation potential category applies to companies, regions, and even people [1]. The innovative potential of the region is revealed, as a rule, on the basis of pooling resources and conditions that stimulate and support innovative activities and innovative aspirations [2, 3, 4, 5, 6]. The development of innovative potential can be viewed as a tool for overcoming the increasing differentiation of Russian



regions, accompanied by agglomeration processes [7]. Researchers of innovation potential interpret it as the ability of a system to transform the actual order of things into a new state to meet existing or emerging needs [8]. More original interpretations are "innovation potential as a set of new products" [9] or "innovation potential as the ability to form new needs" [10]). However, the resource-based approach is the most well-established. It is used not only in definitions, but also in the assessment methods proposed by researchers of the problem. Therefore, the authors of the article proceed from the fact that the innovation potential of a region is a set of resources that ensure the functioning of the region's innovation system.

The existing methods for assessing innovative potential can be divided into simplified and complex ones. The simplified ones use two or four assessment indicators [11, 12, 13]. For example, innovation potential can be equated to the scientific potential of a region [14] or viewed through the prism of human capital [15, 16].

In integrated approaches, the innovative potential of the region is considered as an integral indicator [17, 18, 19, 20], which includes intellectual and personnel, educational, financial and economic, material, entrepreneurial, information and communication, management, legal, institutional, infrastructural, investment, creative, competence potentials.

The use of all the possibilities of the innovative potential, its increment and innovative susceptibility largely depend on the conditions in which the socio-economic system is located. Therefore, the elements of innovation potential often include the conditions for its formation [21], which can also be interpreted as a system of state support for innovation [22]. In this regard, the issues of regional interaction between countries are being actively investigated in the context of the search for factors of growth of innovative potential [23], as well as partnership between business and government in terms of creating and promoting innovative projects [24]. However, this approach, in our opinion, contradicts the resource basis of the innovative potential.

It should be noted that some works are devoted to sectoral aspects of regional innovation potential [25], which somewhat narrows its real essence.

The study of existing publications gives reason to believe that, on the one hand, at the moment there is no universal methodology for assessing the innovative potential and each of its components is assessed by a set of private indicators that are not generally accepted. On the other hand, the assessment mechanism (rating, index method, etc.) varies.

1.3. Features of the border region in the context of the study of its innovative potential

The settlement and arrangement of the territory in Russia are closely interrelated. Therefore, there is often poor infrastructure development in border regions. The border areas remain remote from the Russian market and are practically devoid of significant export resources. At the same time, the border region can be considered as a communication channel with more developed territories outside Russia and the factor of its territorial location can become a competitive advantage over other regions.

The border regions of the Russian Federation occupy 48% of the total area of the country, 47% of its inhabitants live in them. The population density in the border regions is slightly lower than the average for Russia and amounts to 8.3 people per square kilometer versus 8.8 people per square kilometer in the "interior" regions and 8.6 people per square kilometer in the country as a whole (according to calculations based on Federal State Statistic Service).

We disagree with the common opinions regarding the low economic potential of the border zones. The assessment of the average deviation of the regional GRP per capita from the total GRP per capita showed that there is a higher level of economic well-being among the border areas. Thus, among the "internal" territories, there are only five subjects of the federation with the level of regional GRP per capita higher than the value of GRP for Russia as a whole. It is Moscow, the Komi Republic, the Republic of Tatarstan, the Krasnoyarsk region, the Republic of Sakha (Yakutia)). There are ten such subjects among the border regions: Belgorod region, Arkhangelsk region, Leningrad region, Murmansk region, Tyumen region, Magadan region, Sakhalin region, St. Petersburg, Kamchatka Territory, Chukotka Autonomous Area.

The share of border regions in the formation of the gross regional product is about 43%, industrial products - 42%, the number of employees - 45%, investments in fixed assets - 49%, the cost of fixed assets - 46%, exports - 30%, imports - 33%.

The calculation of the Herfindahl-Hirschman Index performed by the authors showed that the concentration of investments in fixed assets, the cost of fixed assets and GRP in the border regions is higher than in the "internal" regions (provided that Moscow is excluded from them as a subject distorting the sample characteristics). Despite the fact that labor resources are distributed relatively evenly across the central and peripheral regions, capital is mostly localized in the border areas of the Russian Federation, which is associated with the high endowment of natural resources in some of these regions. Higher values of the Herfindahl-Hirschman Index also indicate a greater economic imbalance in development. On the basis of this, we concluded that there is a stronger interregional differentiation in the border regions than in the internal territories. Consequently, the role of border entities in the formation of an imbalance in the regional development of the Russian Federation is predominant.

1.4. Research objectives

It is advisable to supplement the components of the innovative potential of the border region with factors of cross-border cooperation. In the published scientific works [26, 27, 28, etc.] their authors analyze the potential of cross-border cooperation, considering it: through the prospects of investment in the economy and cooperation in the socio-cultural sphere; based on the analysis of the resource potential and the level of economic development of border areas; by assessing export-import dominants of interaction; through an audit of the collaborative infrastructure that fosters innovation. Cross-border cooperation is considered as a tool for the development of the economy of a peripheral region, the barrier functions of which are reborn in the modern world as a communication channel, mainly through the exchange of knowledge, innovations, and technological projects. At the same time, these contact resources of the border region are not taken into account when analyzing its innovative potential.

In addition, in our opinion, the amount of contact resources is also determined by the level of urbanization of neighboring regions. The relationship between the level of urbanization and economic development is direct and becomes increasingly close, which is noted in a number of studies [29, 30]. An increase in the concentration of the population in one place leads to many positive effects, expressed in the growth of productivity and the efficiency of innovation.

E. Kutsenko and Y. Eferin substantiated that the scale and intensity of structural changes in the region's economy is largely due to the proximity to million-plus cities, which are compared to Whirlpools, because they intensify economic activity in a large radius from their location [31].

Based on this, it can be argued that the opportunities for innovative development in regions adjacent to those regions in which there is a high level of urbanization are significantly higher than in territories without such a neighborhood.

The objective of this article is to fill in the shortcomings of the existing methods for assessing the innovative potential of the region, at least in two aspects:

- 1) in relation to border areas, it is important to take into account the level of innovative development of adjacent regions, both internal and external;
- 2) in relation to all regions, it is necessary to take into account the level of urbanization of neighboring regions.

2. Methodology

We understand innovative potential as a set of opportunities for implementing innovative activities based on available production, technical, entrepreneurial, digital, scientific and contact resources.

The innovation potential of the border region includes:

- 1) production and technical potential, which is assessed on the basis of indicators:
 - the cost of fixed assets (million rubles per 10 thousand people);
 - new fixed assets (million rubles per 10 thousand people);

- degree of depreciation (%);
- investments in fixed assets (million rubles per 10 thousand people);
- 2) entrepreneurial potential measured on the basis of indicators:
 - number of enterprises and organizations (units per 10 thousand people);
 - share of unprofitable organizations (% of the number of organizations);
 - the number of small businesses (units per 10 thousand people);
- 3) digital potential measured on the basis of indicators:
 - share of organizations using the Internet;
 - share of organizations with a website;
 - number of personal computers per 100 employees;
 - costs for information and communication technologies (million rubles per 10 thousand people);
- 4) scientific potential measured on the basis of indicators:
 - organizations that carried out research and development (units per 10 thousand people);
 - number of personnel engaged in research and development (people per 10 thousand people);
 - internal costs for research and development (million rubles per 10 thousand people);
- 5) contact potential, which is assessed based on indicators:
 - external contact potential;
 - internal contact potential;
 - metropolitan proximity index.

Indicators for assessing the listed components are selected on the basis of statistics generated by Federal State Statistic Service.

The article proposes the following methodology for assessing contact potential:

Stage 1. Determination of the external contact potential of the border region (CP_{out}) based on a comparison of the global innovation index of neighboring states (GII_i) and Russia (GII_{Rus}). The index is formed by a consortium of Cornell University (USA), INSEAD Business School (France) and the World Intellectual Property Organization:

$$CP_{out} = \sqrt[n]{\prod_{i=1}^n \frac{GII_i}{GII_{Rus}}} \quad (1)$$

where n is the number of countries with which the considered Russian region borders.

Stage 2. Assessment of the internal contact potential of the border region (CP_{in}) based on measuring the ratio of the Russian regional innovation index RRII (published by the Higher School of Economics) for this region ($RRII_{BR}$) and neighboring regions of the Russian Federation ($RRII_j$):

$$CP_{in} = \sqrt[m]{\prod_{j=1}^m \frac{RRII_j}{RRII_{BR}}} \quad (2)$$

where m is the number of Russian regions with which the considered border region borders

Stage 3. Assessment of the metropolitan proximity index (I_m) according to the scale developed by the authors: $I_m = 1,1$, if the region borders on a region with a millionaire city; $I_m = 1,05$, if the region borders on a region with a submillionaire city (with a population of more than 700 thousand people); $I_m = 1$, if the region borders on a region that does not have a millionaire city or a submillionaire city.

Stage 4. Integration of the contact potential (CP) based on the averaging of its external and internal components:

$$CP = \frac{CP_{out} + CP_{in}}{2} \cdot I_m \quad (3)$$

The value of $CP > 1$ indicates that the neighboring regions have relatively higher realized opportunities for innovative development, which has a beneficial effect on the innovative potential of the border region, giving it an additional impetus.

The methodology for calculating the innovation potential index of the border region consists of the following steps:

Stage 1. Rationing of basic indicators of production and technical, entrepreneurial, digital, scientific potentials.

To bring the indicators to a comparable form, a standardization procedure is carried out, as a result of which the indices are calculated:

$$I_{X_k} = \frac{X_k}{X_{\max}} \quad (4)$$

$$I_{X_k} = \frac{X_{\min}}{X_k} \quad (5)$$

where X_k is the value of the k -th indicator; $X_{\max}$ is the maximum value of the indicator for all regions; $X_{\min}$ is the minimum value of the indicator for all regions.

Formula (4) is used for direct indicators, formula (5) – for inverse ones.

Stage 2. Integration of indices of basic indicators of production and technical, entrepreneurial, digital, scientific potentials to obtain a component index (I_{comp}).

$$I_{comp} = \sqrt[q]{\prod_{k=1}^q I_{X_k}} \quad (6)$$

where q is the number of basic indicators for production and technical, entrepreneurial, digital, scientific potential.

Stage 3. Assessment of the composite index of the innovative potential of the border region of its five components (I_{IP}):

$$I_{IP} = \frac{\sum_{s=1}^5 I_{comp_s}}{5} \quad (7)$$

3. Results

The classification of Russian border regions in terms of their innovative potential is given in Table 1.

Table 1. Grouping of Russian border regions by level of innovation potential.

Innovation Potential Index		0,560-0,435	0,435-0,310	0,310-0,186
Border regions of Russia	re-of	St. Petersburg, Tyumen region, Chukotka Autonomous Area, Sakhalin Region, Magadan Region	Novosibirsk Region, Leningrad Region, Kamchatka Territory, Murmansk Region, Amur Region, Altai Territory, Trans-Baikal Territory, Omsk Region, Kaliningrad Region, Republic of Karelia, Primorye Territory, Voronezh Region, Khabarovsk Territory	Chelyabinsk Region, Sevastopol, Republic of Crimea, Arkhangelsk Region, Kursk Region, Belgorod Region, Altai Republic, Saratov Region, Orenburg Region, Rostov Region, Krasnodar Region, Jewish Autonomous Region, Smolensk Region, Republic of Tuva, Pskov Region, Volgograd Region, Bryansk Region, Kurgan Region, Astrakhan Region, Karachayevo-Circassian Republic, Republic of Ingushetia, Republic of Kalmykia, Republic of North Ossetia - Alania, Republic of Buryatia, Kabardino-Balkarian Republic, Chechen Republic, Republic of Dagestan

The average value of the Innovation Potential Index in 2018 for all border regions of the Russian Federation is 0.305, taking into account the contact potential and 0.265, without taking it into account. At the same time, the average value of this indicator for the "internal" regions of the Russian Federation is 0.276. In other words, taking into account the contact functions of the border region in the methodology for assessing its innovative potential makes it possible to more fully take into account the possibilities of innovative cooperation.

The results of the analysis made it possible to concretize the list of problems for the formation and development of the innovative potential of the border region, associated with the need to intensify efforts to increase the scientific, contact, production and technical components of the potential.

4. Conclusions

It has been analytically confirmed that the border regions of Russia represent a special kind of periphery, in which signs of backwardness from the center are not so strongly expressed. At the same time, they have a stronger interregional differentiation than in the internal territories.

Based on this, the role of border regions in the formation of an imbalance in regional development is predominant. Therefore, the assessment and improvement of the innovative potential of border regions plays an important role in leveling the country's economic development.

As a result of diagnostics of the existing methods for assessing the innovative potential of the region, it was revealed that there is no universal composition of components and private indicators of innovative potential.

It has been determined that in relation to the border region, it is necessary to include the contact potential in the innovation potential, the calculation algorithm for which is proposed by the authors of the article.

Innovation potential is understood as a set of opportunities for implementing innovative activities based on available resources of a production-technical, entrepreneurial, digital, scientific and contact nature.

Approbation of the proposed methodology made it possible to identify leaders among border regions, as well as to group border regions according to their level of innovation potential. The results of the analysis made it possible to concretize the list of problems for the formation and development of the innovative potential of the border region associated with the need to intensify efforts to increase the scientific, contact, production and technical components of the potential.

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